

Marine Acoustic Acquisition System

Background

Marine Institute

Applications

Acquisition Systems
& Software Systems

Current Developments

Data Analysis using
Nvidia CUDA

Understanding
Requirements

Omiga Technology Ltd was founded in 2000 providing bespoke software and hardware solutions for high speed data acquisition systems and data analysis.

The majority of solutions provided are based on National Instruments realtime platforms and FPGA (field programmable gate arrays).

In-house systems design and assembly utilizing equipment from manufacturers such National Instruments and Siemens.



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Applications:

Acoustic Acquisition System Development

Dual channel acquisition system with local storage and streaming capability
Hot swappable hard disks
PV sensor serial and analog acquisition channels

Low Power Acoustic Acquisition System

Single channel acquisition system
PV sensor serial and analog acquisition channels
Data streaming only

Array Acquisition System -

Multichannel acquisition system (12 hydrophones each with high and low gain channels, dynamic channel switching)
Power management system (remote power control)
PV sensor serial and analog acquisition channels (6 sensors, 24 analog channels)

Ethernet Data Logging System

Low power ethernet storage system developed to complement the low power acquisition system providing local storage. If the local disks are full data can be streamed to a remote location. Remote control of logging and status feedback

Basic Setup & Analysis Software

Common data retrieval and basic analysis software allowing visualisation of acquired data or data streamed from an acquisition system in realtime



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Acquisition Systems

Omiga has provided a number of different acquisition systems to the Marine Institute. The latest system known as the Array system takes a number of the previous development features and combines these into a single system.

The array system has the following capabilities:

12 hydrophone acquisition channels streamed to remote storage

Low voltage power supply system

High gain amplifiers (FPGA threshold triggered changeover)

Serial and analog acquisition from PV sensors

Remotely controlled supply fusing (overcurrent reset, monitoring via remote communications)



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Omega Internal Development - Dual Channel Acquisition System

Building on existing system as part of our internal development program we have manufactured a dual channel system to allow us to develop the acquisition system further and provide additional software features.

These are:

- Dual channel acquisition from a single hydrophone with high and low gain amplifier channels.
- Automatic channel changeover (between high and low gain)
- Realtime threshold triggered flagging (frequency of interest and amplitude)
- Realtime data streaming – can be linked to local storage device if desired
- Low power consumption
- Frequency calibration for hydrophone channels
- Smaller footprint, easily portable

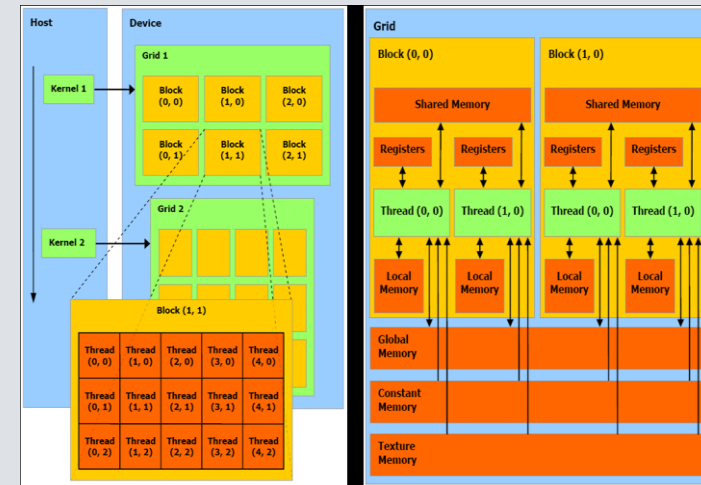
Data Analysis Developments

Microsoft platforms used for basic data analysis of captured data are slow. Omiga has been working on development of a new analysis application that leverages from the performance enhancements provided by GPU processing using nVidia CUDA.

Conventional graphic cards generally make use of hundreds if not thousands of computational cores. Testing was carried out to find out if GPU's could be used to process 'big data'. Intensive load testing was carried out using an NVidia GTX 1080 graphic card to understand how GPU technology can be used in the processing of acoustic data. This particular graphics card, boasts 2560 logical CUDA cores. A diagram below shows how cores, correlate to grids, blocks and then threads (that actually do the number crunching). The FFT algorithm used in testing is an adaptation of [FFTW](#)

Tests of FFT processing using the CUDA library supported by the LabView framework, were carried out to discover how much data the GPU could actually process. It would possible for the GPU to perform data calibration prior to FFT analysis

Time (ms)	Data point volume
650	500,000 (1 second for single a ch)
1900	5,000,000
2700	10,000,000



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Further Development

We are currently at a stage in development where we can demonstrate the advantages of GPU processing to reduce the time required to handle the large amounts of data.

We now need to fully understand the output requirements so we can focus our efforts for the best results so please tell us what you would like to see.

